09/380519

PRV SE 99/01259

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(21) *Patentansökningsnummer* / *Patent application number* — *9901998-6*

(86) *Ingivningsdatum* / *Date of filing* — *1999-05-31*

Stockholm, 1999-08-20

För Patent- och registreringsverket
For the Patent- and Registration Office

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A MOUNTING APPARATUS

The present invention relates to a mounting apparatus for mounting an expandable endless cord or band such as an elastic cord or O-ring on an end of a structure which has a transverse dimension greater than that of the cord when in a contracted condition. The invention is particularly, although not exclusively, concerned with a mounting apparatus for mounting an elastic endless cord or band on a surgical instrument for ligating internal tissues of a cavity in the human body by means of the elastic cord or band, one example being the ligation of haemorrhoids.

A surgical instrument for ligating haemorrhoids is disclosed in European patent EP 0310582 B1, the contents of which are incorporated herein by reference. This surgical instrument, which will be referred to herein as a "surgical instrument of the type defined", includes an inner front cylinder with the elastic cord stretched around its front end and an outer discharge cylinder displaceably arranged on the inner front cylinder to push the elastic cord off the inner front cylinder to close around the stem of a haemorrhoid when inserted in the inner front cylinder.

In its normal "rest" condition the generally circular elastic cord is of considerably smaller diameter than the external diameter of the inner front cylinder. The elastic cord is mounted on the inner front cylinder by means of a conical adaptor of circular cross-section having a larger rear end which makes a push fit in the inner front cylinder. The adaptor is tapered forwardly to its pointed front end which fits into the elastic cord when in its rest condition. The cord is then pushed or rolled by hand along the adaptor on to the inner front cylinder by the user, usually the surgeon. Difficulties arise because the elastic cord is small and the user has to wear gloves as protection against infection. This is especially true when the user has to perform several consecutive ligations.

It is an aim of the invention to alleviate the above-mentioned difficulties.

According to a first aspect of the invention there is provided a mounting apparatus for mounting an endless cord which is expandable from a contracted condition to an expanded condition onto an end of a structure having a first transverse dimension greater than that of the cord when in the contracted condition, said apparatus comprising a tapered adaptor for the cord to be propelled along onto the end of the structure having a forward smaller end for location in the cord in its contracted condition and a rear larger end of a second transverse dimension at least substantially the same as the first transverse dimension for juxtaposing with the end of the structure and an expander device movable relative to the adaptor to propel the cord along the adaptor onto the rear larger end thereof.

In an embodiment of the invention such as one hereinafter to be described the rear larger end of the adaptor is a rear section having the second transverse dimension.

In an embodiment of the invention such as one hereinafter to be described the end of the structure and the rear larger end of the adaptor each have a generally circular outer surface profile with a diameter corresponding respectively to the first and second transverse dimensions.

In an embodiment of the invention such as one hereinafter to be described the forward smaller end of the adaptor is presented by a central member.

In an embodiment of the invention such as one hereinafter to be described the adaptor includes a conical section tapering from the rear larger end towards the forward smaller end.

In an embodiment of the invention such as one hereinafter to be described the conical section of the adaptor comprises a plurality of circumferentially spaced-apart fingers mounted at their rear ends to the rear larger end. Preferably, the fingers are equi-spaced from one another. The fingers may also be connected to the central member.

In an embodiment of the invention such as one hereinafter to be described the expander device is operable in a first mode to propel the cord along the adaptor onto the rear larger end thereof and in a second mode to propel the cord from the rear larger end onto the end of the structure.

In an embodiment of the invention such as one hereinafter to be described the expander device includes a conical section adapted to mesh with the conical section of the adaptor to propel the cord along the adaptor to the rear larger end thereof.

In an embodiment of the invention such as one hereinafter to be described the conical section of the expander device comprises a plurality of circumferentially spaced-apart arms insertable between the fingers of the adaptor.

In an embodiment of the invention such as one hereinafter to be described the expander device comprises a tubular section adapted to slide over the adaptor to propel the cord from the rear larger end onto the end of the structure.

The adaptor and the expander device may each be made from a plastics material such as polypropylene, for instance by injection moulding. The central member of the adaptor may, on the other hand, be made of metal instead.

The mounting apparatus of the invention is particularly, although not exclusively, suited for mounting an elastic cord onto a ligating end of a surgical instrument for

ligating internal body tissue, for example the inner front cylinder of a surgical instrument of the type defined.

According to a second aspect of the invention there is provided a surgical kit comprising a mounting apparatus according to the first aspect of the invention. The surgical kit may further comprise a surgical instrument for ligating internal body tissue.

According to a third aspect of the invention there is provided a method of mounting an endless cord which is expandable from a contracted condition to an expanded condition onto an end of a structure having a first transverse dimension greater than the transverse dimension of the cord in its contracted condition comprising the steps of providing a tapered adapter having a forward smaller end and a rear larger end of a second transverse dimension at least substantially the same as the first transverse dimension, juxtaposing the rear larger end of the tapered adaptor to the end of the structure, propelling the elastic cord along the tapered adaptor onto the rear larger end thereof by displacement of an expander device rearwardly with respect to the adaptor and propelling the elastic cord from the rear larger end of the adaptor onto the end of the structure.

In an embodiment of the invention the expander device is adapted to propel the cord along the tapered adaptor and onto the end of the structure by displacement of the expander device rearwardly with respect to the adaptor.

By way of example, an embodiment of the invention will now be described with reference to the accompanying Figures of drawings in which:-

Figure 1 is a side elevation, partly in section, of a surgical instrument of the type defined in a rest position,

Figure 2 is side elevation of the instrument of Figure 1 in an actuated position,

Figure 3 is an enlarged sectional view along the line III-III in Figure 1,

Figure 4 is an enlarged sectional view along the line IV-IV in Figure 1,

Figure 5 is a side elevation of an adaptor of a mounting apparatus in accordance with the invention,

Figure 6 is a front view of the adaptor of Figure 5,

Figure 7 is a rear view of the adaptor of Figure 5,

Figure 8 is a perspective view of the adaptor of Figure 5,

Figure 9 is a side elevation of an expander device of the mounting apparatus in accordance with the invention,

Figure 10 is a front view of the expander device of Figure 9,

Figure 11 is a rear view of the expander device of Figure 9,

Figure 12 is a perspective view of the expander device of Figure 9,

Figure 13 is a side elevation of the adaptor of Figure 5 supporting an elastic cord and the expander device of Figure 9 in a first mode of operation for propelling the cord along the adaptor,

Figure 14 is a side elevation corresponding to Figure 13 with the expander device in its first mode of operation located on the adaptor and the elastic cord having

been propelled by the expander device onto a rear cylindrical section of the adaptor,

Figure 15 is a perspective view of the expander device of Figure 9 in its first mode of operation located on the adaptor of Figure 5,

Figure 16 is a side elevation of the adaptor of Figure 5 with the cord supported on the rear cylindrical section thereof and the expander device of Figure 9 in a second mode of operation for pushing the cord off the rear cylindrical section,

Figure 17 is a side elevation corresponding to Figure 16 with the expander device in its second mode of operation located on the adaptor and the elastic cord having been pushed to the rear edge of the rear cylindrical section of the adaptor, and

Figure 18 is a side elevation, partly in section, of the expander device of Figure 9 in its second mode of operation located on the adaptor of Figure 5 with the elastic cord having been pushed off the rear end of the rear cylindrical section of the adaptor.

In Figures 1 to 4 there is shown a surgical instrument for the ligation of haemorrhoids in a patient having an angle profiled tube (4) which is connected at its front end to an inner front cylinder (1) having an inner volume dimensioned to receive a located haemorrhoid (12).

As shown in Figures 3 and 4, the angled tube (4) is divided longitudinally by a partition wall (9) into a first part (7) and a second part (8). The first part (7) of the tube is adapted to be connected to a vacuum source at its rear end. A restriction hole (10) is situated in the upper side of the tube (4) in a position that is convenient to reach by an operator's finger or thumb when the operator's hand grips a rear angled part of the tube (4) while handling the instrument. The size of the hole (10)

is such that it is capable of being covered by the finger or thumb of the operator.

Figure 1 shows the surgical instrument in a rest position in which an outer discharge cylinder (3) is displaceably mounted on the inner front cylinder (1) in a rearward rest position relative to the inner front cylinder (1) and an elastic cord (2) is stretched around the front part of the inner front cylinder (1). The discharge cylinder (3) is connected to one end of a strip (5) which extends rearwardly in the second part (8) of the tube from the outer discharge cylinder (3) to a forward guiding hole (11) positioned in the lower side of the rear angled part of the tube (4), out of the forward guiding hole (11), back into the tube (4) through a rear guiding hole (13) longitudinally spaced from the forward guiding hole (11) and to the rear part of the tube (4) where it is secured. The part of the strip (5) outside the tube (4) between the forward and rear guiding holes (11, 13) forms an actuating loop (6) the purpose of which will become clear hereinafter.

In operation, the rear end of the first part (7) of the tube (4) is connected to a vacuum source and the forward part of the tube (4) is inserted into the anal cavity of the patient's body. The restriction hole (10) is covered by the operator's finger or thumb to create a vacuum in the inner front cylinder (1) whereby a located haemorrhoid (12) is sucked into the inner front cylinder (1). By means of the fingers of the operator's hand, the actuating loop (6) is pressed towards the tube (4) causing the strip (5) to push the outer discharge cylinder (3) forwardly on the inner front cylinder (1). As shown in Figure 2, the forward movement of the outer discharge cylinder (3) on the inner front cylinder (1) pushes the elastic cord (2) off the inner front cylinder (1) onto the base of the haemorrhoid (12) to shut off the blood circulation thereto.

The restriction hole (10) is then opened to counterbalance the vacuum in the inner front cylinder (1) whereupon the instrument is removed from the anal cavity of the patient and the discharge cylinder (3) displaced back to its rearward rest

position by the strip (5) ready for another elastic cord (2) to be mounted on the front part of the inner front cylinder (1).

To this end, a mounting apparatus in accordance with the present invention is provided for mounting the elastic cord (2) on the front part of the inner front cylinder (1) of the surgical instrument so that a further ligation can be carried out.

As shown in Figures 5 to 8, the mounting apparatus includes an adaptor (14) which is attachable to the inner front cylinder (1). The adaptor (14) has a central rod (16) extending forwardly along the axis of a cylindrical body (18). The rear end of the rod (16) is connected to the cylindrical body (18) and the forward end of the rod (16) is sufficiently small to enter the elastic cord (2) when in its rest or contracted condition. A mounting plug (20) extends rearwardly from the cylindrical body (18) and is dimensioned so as to make a push fit in the inner front cylinder (1) of the surgical instrument in order to mount the adaptor on the inner front cylinder (1). When mounted on the inner front cylinder (1), the outer surface of the cylindrical body (18) of the adaptor (14) is flush with or slightly larger in diameter than the outer surface of the inner front cylinder (1).

Four equi-spaced fingers (22) are mounted at their rear ends to the circumference of the cylindrical body (18). These fingers (22) converge towards the central rod (16) such that the forward ends of the fingers (22) rest on the central rod (16) immediately behind the forward end of the central rod (16).

The adaptor (14) may be made of any suitable plastics material such as polyvinyl chloride or the thermoplastic material polypropylene, for example by injection moulding. Alternatively, the central rod (16) may be made of any suitable metal with the rest of the adaptor (14) being formed from a plastics material.

Referring now to Figures 9 to 12, the mounting apparatus further comprises an

expander device (24) having four equi-spaced arms (26) mounted at their rear ends to the circumference of the forward end of a tube (28). The arms (26) converge from the circumference of the tube (28) so that their forward ends (30) are spaced apart at a distance equal to or slightly greater than the diameter of the central rod (16) of the adaptor (14). The tube (28) is dimensioned so as to make an easy sliding fit on the cylindrical body (18) of the adaptor (14).

The expander device (24) may be made of any suitable plastics material such as polyvinyl chloride or the thermoplastic material polypropylene, for example by injection moulding.

In operation of the mounting apparatus, the adaptor (14) is attached to the inner front cylinder (1) of the surgical instrument and the elastic cord (2) is placed on the tip of the central rod (16) as previously described. As will be understood by reference to Figures 13 to 15, the expander device (24) is manoeuvred to locate the forward ends (30) of the arms (26) of the expander device (24) around the central rod (16) of the adaptor (14) in the spaces between the fingers (22) so that the arms (26) and fingers (22) mesh with one another. The expander device (24) is then pushed into the adaptor (14) thereby causing the arms (26) to push the elastic cord (2) along the fingers (22) and onto the forward part of the cylindrical body (18) of the adaptor (14). As shown in Figure 14, when the elastic cord (2) has reached this position the forward ends (30) of the arms (26) come into contact with a front face (32) of the cylindrical body (18) thereby preventing further movement of the arms (26) into the adaptor (14).

As will be understood by reference to Figures 16 to 18, the expander device (24) is then withdrawn from the adaptor (14), turned around and the tube (28) slid over the cylindrical body (18) of the adaptor (14) to push the elastic cord (2) from the cylindrical body (18) onto the inner front cylinder (1) of the surgical instrument. The adaptor (14) and expander device (24) are then removed from the inner front

cylinder (1) leaving the surgical instrument ready for ligating another haemorrhoid.

It is envisaged that the adaptor (14) and the expander device (24) may be designed so that the above-mentioned first movement of the expander device (24) onto the adaptor (14) will locate the elastic cord (2) on the inner front cylinder (1) of the surgical instrument thus avoiding the need to withdraw and reverse the expander device (24) onto the adaptor (14).

The mounting apparatus described hereinabove with reference to the accompanying Figures of drawings reduces the problems encountered when an operator of the surgical instrument has to manipulate the elastic cord with a gloved hand.

It will be understood that the present invention has been described in relation to an exemplary embodiment and can be modified in many different ways within the scope of the invention as defined by the appended claims. Finally, it should be noted that the reference numerals in the appended claims are solely for guidance and not to be construed as having a limiting effect on the claims.

CLAIMS

1. A mounting apparatus for mounting an endless cord (2) which is expandable from a contracted condition to an expanded condition onto an end (1) of a structure having a first transverse dimension greater than that of the cord when in the contracted condition, said apparatus comprising a tapered adaptor (14) for the cord to be propelled along onto the end of the structure having a forward smaller end (16) for location in the cord in its contracted condition and a rear larger end (18) of a second transverse dimension at least substantially the same as the first transverse dimension for juxtaposing with the end of the structure characterised in that said apparatus further comprises an expander device (24) movable relative to the adaptor to propel the cord along the adaptor onto the rear larger end thereof.

2. A mounting apparatus as claimed in claim 1, characterised in that the rear larger end of the adaptor is a rear section (18) having the second transverse dimension.

3. A mounting apparatus as claimed in claim 1 or claim 2, characterised in that the forward smaller end of the adaptor is presented by a central member (16).

4. A mounting apparatus as claimed in any one of the preceding claims, characterised in that the adaptor includes a conical section tapering from the rear larger end towards the forward smaller end.

5. A mounting apparatus as claimed in claim 4, characterised in that the conical section of the adaptor comprises a plurality of circumferentially spaced-apart fingers (22) mounted at their rear ends to the rear larger end.

6. A mounting apparatus as claimed in claim 5, characterised in that the

fingers are equi-spaced from one another.

7. A mounting apparatus as claimed in claim 5 or claim 6 when appendant to claim 3, characterised in that the central member and the fingers are connected to one another.

8. A mounting apparatus as claimed in any one of the preceding claims, characterised in that the adaptor is made of a plastics material.

9. A mounting apparatus as claimed in claim 8, characterised in that the adaptor is injection moulded from the plastics material.

10. A mounting apparatus as claimed in claim 3, characterised in that the central member is made of metal.

11. A mounting apparatus as claimed in any one of the preceding claims, characterised in that the expander device is operable in a first mode thereof to propel the cord along the adaptor on to the rear larger end thereof and in a second mode thereof to propel the cord from the rear larger end onto the end of the structure.

12. A mounting apparatus as claimed in claim 11 when appendant to claim 4, characterised in that the expander device includes a conical section adapted to mesh with the conical section of the adaptor to propel the cord along the adaptor to the rear larger end thereof.

13. A mounting apparatus as claimed in claim 11 when appendant to claim 5 or 6, characterised in that the expander device includes a conical section which comprises a plurality of circumferentially spaced-apart arms (26) insertable between the fingers of the adaptor to propel the cord along the adaptor to the rear

larger end thereof.

14. A mounting apparatus as claimed in any one of claims 11 to 13, characterised in that the expander device includes a tubular section (28) adapted to slide over the adaptor to propel the cord from the rear larger end thereof onto the end of the structure.

15. A mounting apparatus as claimed in any one of the preceding claims, characterised in that the expander device is made of a plastics material.

16. A mounting apparatus as claimed in claim 15, characterised in that the expander device is injection moulded from the plastics material.

17. A mounting apparatus as claimed in any one of the preceding claims for mounting an elastic cord onto a ligating end of a surgical instrument for ligating internal body tissue.

18. A surgical kit comprising a mounting apparatus as claimed in any one of claims 1 to 17.

19. A surgical kit as claimed in claim 18 including a surgical instrument for ligating internal body tissue.

20. A method of mounting an endless cord (2) which is expandable from a contracted condition to an expanded condition onto an end (1) of a structure having a first transverse dimension greater than the transverse dimension of the cord in its contracted condition comprising the steps of providing a tapered adapter (14) having a forward smaller end (16) and a rear larger end (18) of a second transverse dimension at least substantially the same as the first transverse dimension, juxtaposing the rear larger end of the tapered adaptor to the end of the

structure, propelling the elastic cord along the tapered adaptor onto the rear larger end thereof by displacement of an expander device (24) rearwardly with respect to the adaptor and propelling the elastic cord from the rear larger end of the adaptor onto the end of the structure.

21. A method as claimed in claim 20, characterised by displacing the expander device rearwardly with respect to the adaptor to move the cord over the tapered adaptor onto the end of the structure.

22. A mounting apparatus for mounting an endless cord (2) which is expandable from a contracted condition to an expanded condition onto an end (1) of a structure having a first transverse dimension greater than that of the cord when in the contracted condition substantially as herein described with reference to and illustrated by the accompanying Figures of drawings.

23. A method of mounting an endless cord (2) which is expandable from a contracted condition to an expanded condition onto an end (1) of a structure having a first transverse dimension greater than the transverse dimension of the cord in its contracted condition substantially as herein described with reference to and illustrated by the accompanying Figures of drawings.

ABSTRACT

A Mounting Apparatus

Mounting apparatus for mounting an endless cord (2) which is expandable from a contracted condition to an expanded condition onto an end (1) of a structure having a first transverse dimension greater than that of the cord when in the contracted condition comprising a tapered adaptor (14) for the cord to be propelled along onto the end of the structure having a forward smaller end (16) for location in the cord in its contracted condition and a rear larger end (18) of a second transverse dimension at least substantially the same as the first transverse dimension for juxtaposing with the end of the structure and an expander device (24) movable relative to the adaptor to propel the cord along the adaptor onto the rear larger end thereof.

(Figure 13)

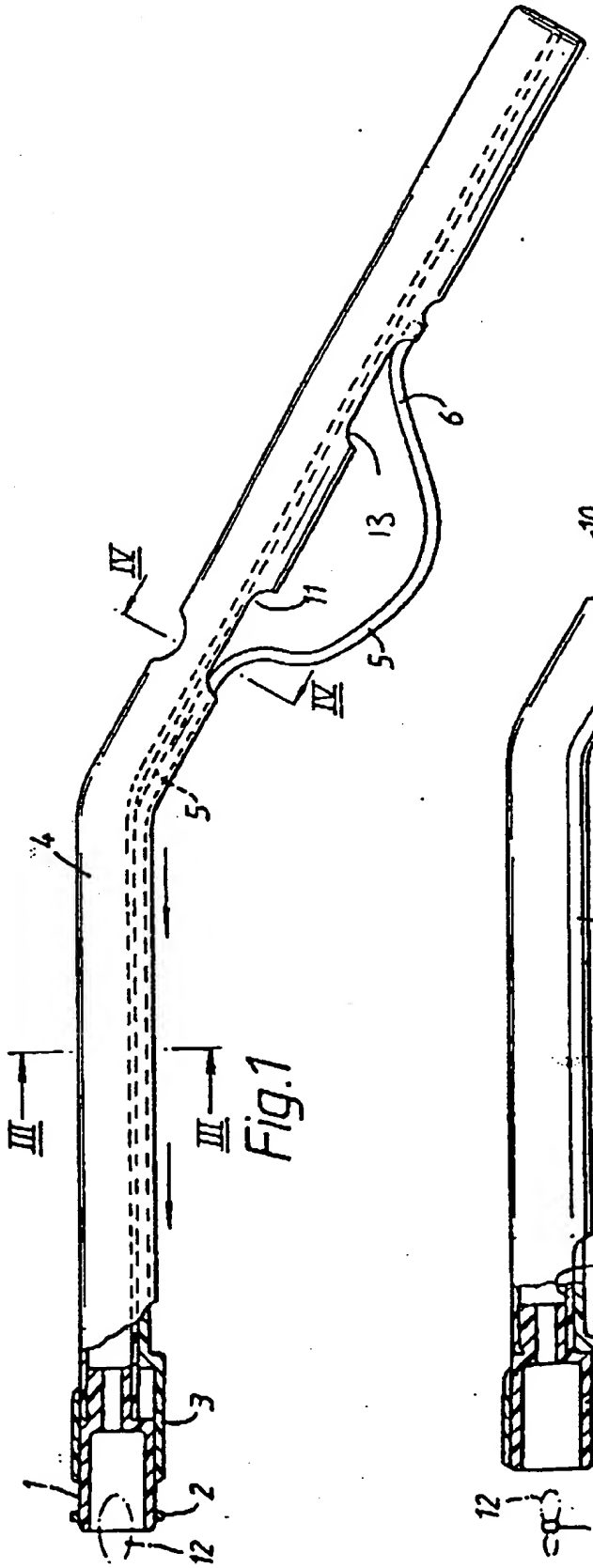

Fig.1

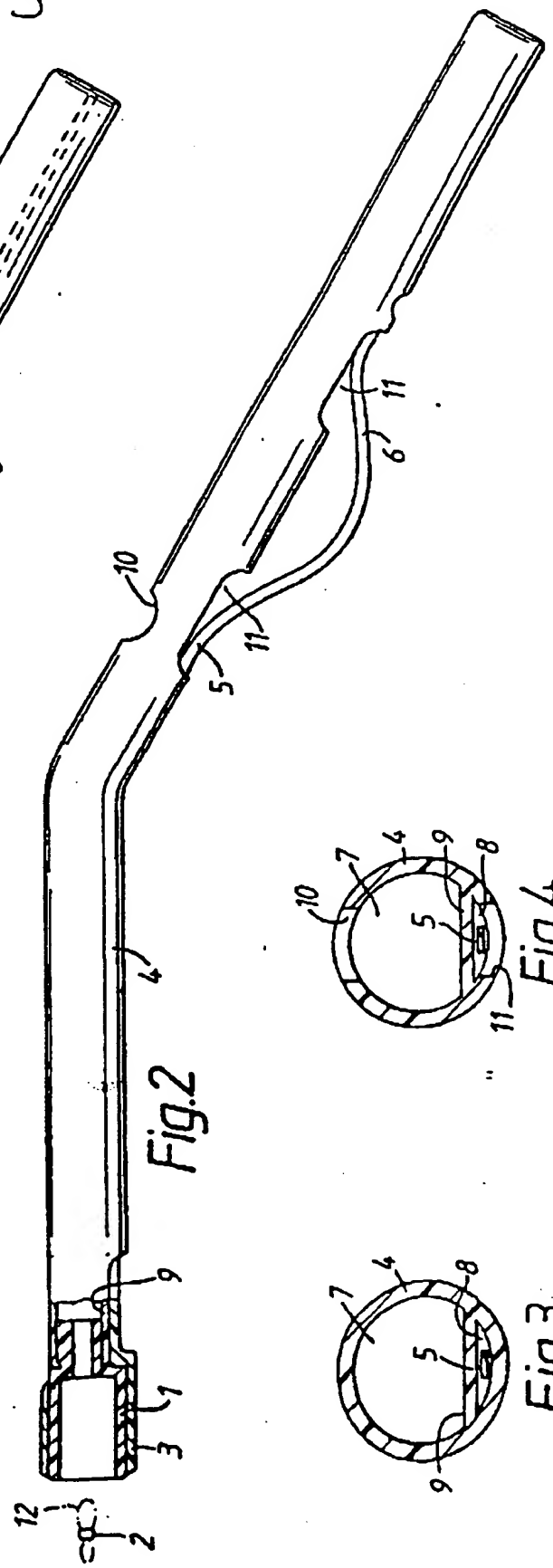

Fig.2

Fig.4

Fig.3

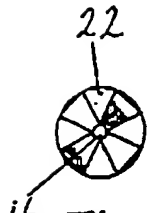

Fig.6

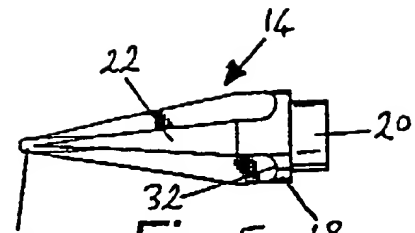

Fig.5

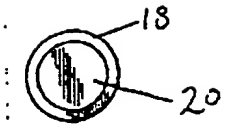

Fig. 7

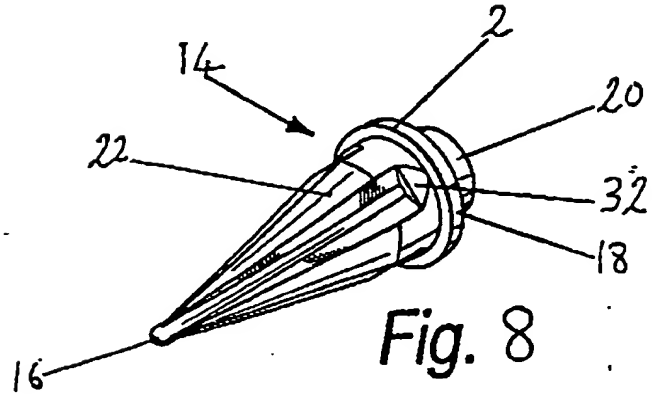

Fig. 8

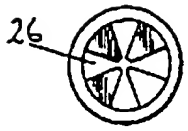

Fig. 11

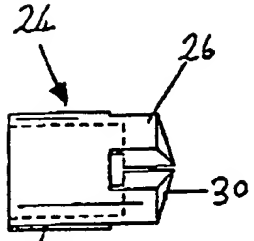

Fig. 9

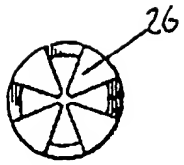

Fig. 10

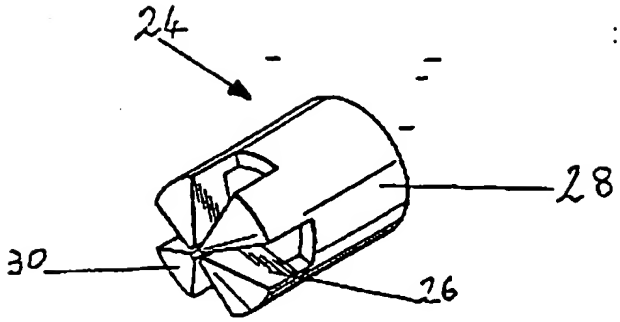

Fig. 12

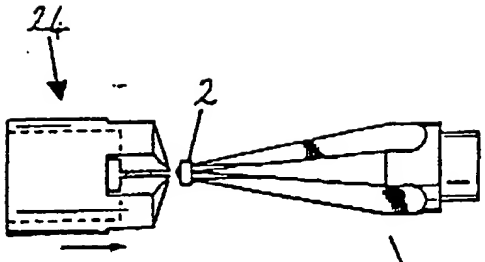

Fig. 13

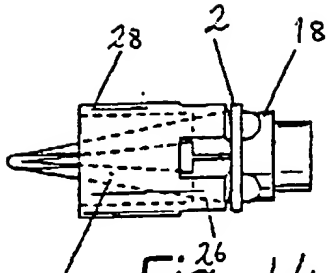

Fig. 14

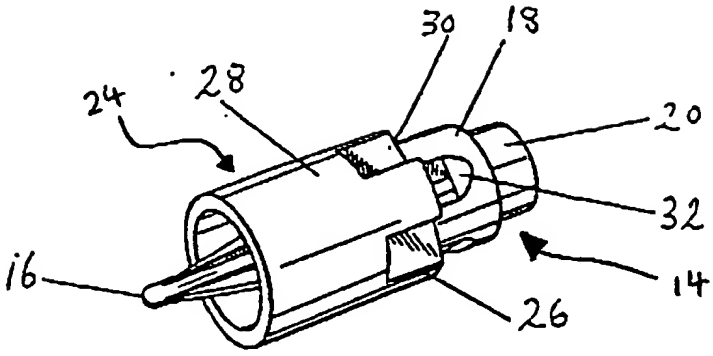

Fig. 15

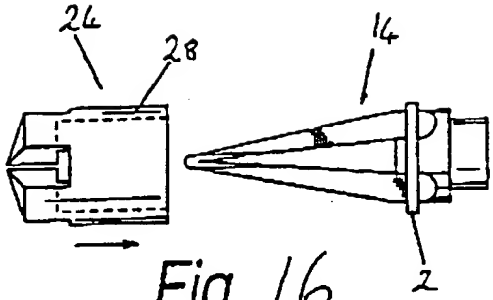

Fig. 16

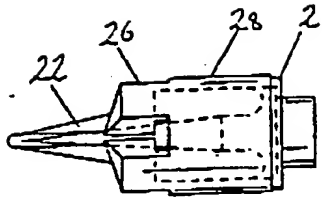

Fig. 17

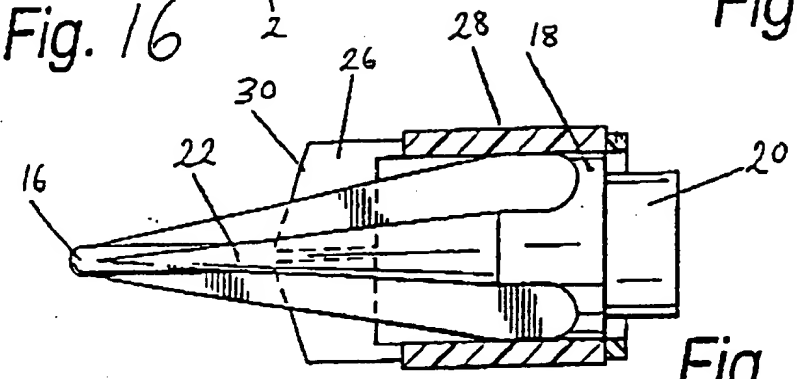

Fig. 18

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